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RELIABILITY ENHANCEMENT OF A TRAFFIC SIGNAL LIGHT SYSTEM USING A MEAN-VARIANCE APPROACH

Abstract

Traffic accidents cause tragic loss of life, property damage and substantial congestion to transportation systems. A large percentage of crashes occur at or near intersections. Therefore, traffic signals are often used to improve traffic safety and operations. The objective of this study is to present a significant and effective method of determining the optimal investment involved in retrofitting signals with light emitting diode (LED) units. In this study, the reliability and risks of each unit are evaluated using a variance-covariance matrix, and the effects and expenses of replacement are analyzed. The mean-variance analysis is formulated as a mathematical program with the objectives of minimizing the risk and maximizing the expected return. Finally, a structural learning model of a mutual connection neural network is proposed to solve problems defined by mixed-integer quadratic programming, and this model is employed in the mean-variance analysis. Our method is applied to an LED signal retrofitting problem. This method enables us to select results more effectively and enhance decision-making.